

CLAIM AMENDMENTS

1 1. (previously presented) A method of converting a
2 silicon on insulator (SOI) substrate into a strained SOI substrate,
3 the method comprising the steps of:

4 providing an SOI substrate having a thin silicon layer
5 and an insulator;

6 providing at least one first epitaxial relaxing layer on
7 the SOI-substrate,

8 producing a defect region in a layer above the silicon
9 layer of the SOI-substrate, and

10 relaxing the first layer by a thermal treatment in an
11 inert atmosphere to simultaneously strain the silicon layer of the
12 SOI-substrate via dislocation mediated strain transfer and to
13 produce the strained silicon layer directly on the insulator.

1 2. (previously presented) The method according to claim
2 1, further comprising the step of

3 forming defects that give rise to relaxation of at least
4 one neighboring layer of the layer which is to be strained.

1 3. (previously presented) The method according to claim
2 1, further comprising the step of

3 subjecting the layer structure for relaxation to a
4 thermal treatment and/or oxidation.

1 4. (previously presented) The method according to
2 claim 1, further comprising the step of
3 depositing the first layer upon the silicon layer to be
4 strained.

1 5. (currently amended) The method according to claim 4
2 wherein the first layer has a different degree of stress strain
3 than the silicon layer to be strained.

4 6. (previously presented) The method according to claim
5 4 wherein the defect region is produced in the first layer.

7 - 9. (canceled)

1 10. (currently amended) The method according to claim 1
2 wherein two neighboring layers of the layer to be strained have
3 other degrees of stress strain than the layer to be strained.

1 11. (previously presented) The method according to
2 claim 1 wherein a plurality of layers are relaxed.

1 12. (previously presented) The method according to
2 claim 1 wherein a plurality of layers to be strained have strain
3 transferred to them.

1 13. (previously presented) The method according to
2 claim 1, further comprising the step of
3 depositing on the first layer epitaxially at least one
4 second layer with a different lattice structure.

1 14. (previously presented) The method according to
2 claim 13 wherein the defect region is produced in the second layer.

1 15. (previously presented) The method according to
2 claim 1 wherein on the layer to which strain is to be transferred
3 at least one graded layer is deposited as the first layer.

1 16. (previously presented) The method according to
2 claim 15 wherein at the region of the layer to be strained, the
3 graded layer has a degree of strain that is different from that of
4 the layer to be strained.

1 17. (previously presented) The method according to
2 claim 15, further comprising the step of
3 producing a defect region in the graded layer.

4 18. (previously presented) The method according to
5 claim 1, further comprising the step of
6 depositing an epitaxial layer structure comprising a
7 plurality of layers on the substrate.

19. (canceled)

1 20. (currently amended) The method according to claim 1
2 [[9]] wherein the thermal treatment is done at a temperature
3 between 550 degrees and 1200 degrees C.

1 21. (currently amended) The method according to claim 1
2 [[9]] wherein the thermal treatment is done at a temperature
3 between 700 degrees and 980 degrees C.

22 - 23. (canceled)

1 24. (previously presented) The method according to
2 claim 1 wherein the relaxation is carried out over a limited region
3 of a layer.

4 25. (previously presented) The method according to
5 claim 1, further comprising the step of
6 applying a mask.

26 - 27. (canceled)

1 28. (previously presented) A method of converting a
2 silicon on insulator (SOI) substrate into a strained SOI substrate,
3 the method comprising the steps of:

4 providing an SOI substrate having a thin silicon layer
5 and an insulator;

6 providing at least one first epitaxial relaxing layer on
7 the SOI-substrate,

8 producing a defect region in a layer above the silicon
9 layer of the SOI-substrate by ion implantation of hydrogen ions or
10 helium ions with a dose of 3×10^{15} to $4 \times 10^{16} \text{ cm}^{-2}$, and

11 relaxing the layer above the silicon layer by a thermal
12 treatment to simultaneously strain the silicon layer of the SOI-
13 substrate via dislocation mediated strain transfer and to produce
14 the strained silicon layer directly on the insulator.

29 - 34. (canceled)

1 35. (previously presented) The method according to
2 claim 13, further comprising out the step of
3 carrying out two implantations to produce two defect
4 regions in the first layer and in the second layer.

1 36. (previously presented) The method according to
2 claim 28, further comprising the step of

3 tilting the substrate during the ion implantation at an
4 angle greater than 7°.

37. (canceled)

1 38. (previously presented) The method according to
2 claim 1 wherein the defect region is produced by a change in the
3 temperature during the formation of one of the layers.

1 39. (previously presented) The method according to
2 claim 1 wherein the defects are produced in a Si-C layer by thermal
3 treatment.

40 - 41. (canceled)

1 42. (previously presented) The method according to
2 claim 1 wherein a silicon surface layer of the SOI substrate is the
3 layer to be strained and the SiO₂ of the SOI substrate forms the
4 insulator of the substrate.

1 43. (previously presented) The method according to
2 claim 1 wherein an SIMOX or BESOI substrate is selected as a base
3 structure for the substrate.

1 44. (previously presented) The method according to
2 claim 1, further comprising the step of
3 selecting a silicon on sapphire as a base structure for
4 the substrate.

1 45. (previously presented) The method according to
2 claim 1 wherein the layer neighboring the silicon layer becomes
3 viscous at a temperature required for the relaxation.

46 - 47. (canceled)

1 48. (previously presented) The method according to
2 claim 1 Si-Ge or Si-Ge-C or Si-C as the material for the first
3 layer which is deposited on the layer to be strained.

49. (canceled)

1 50. (previously presented) The method according to
2 claim 13 wherein silicon as the material for the second layer which
3 is deposited upon the first layer.

1 51. (previously presented) The method according to
2 claim 15, further comprising the step of
3 selecting Si-Ge as the material for a graded layer.

1 52. (previously presented) The method according to
2 claim 51 wherein the germanium concentration in the graded layer
3 decreases from the interface with the layer to be strained to the
4 surface of the graded layer.

1 53. (previously presented) The method according to
2 claim 15 wherein the germanium concentration in a Si-Ge layer at
3 the interface with the layer to be strained is 100 percent.

54. (canceled)

1 55. (previously presented) A method of converting a
2 silicon on insulator (SOI) substrate into a strained SOI substrate,
3 the method comprising the steps of:

4 providing an SOI substrate having a thin silicon layer
5 and an insulator;

6 growing at least one first epitaxial relaxing layer on
7 the SOI-substrate,

8 producing a defect region in a layer above the silicon
9 layer of the SOI-substrate,

10 relaxing the layer above the silicon layer by a thermal
11 treatment to simultaneously strain the silicon layer of the SOI-
12 substrate via dislocation mediated strain transfer and to produce
13 the strained silicon layer directly on the insulator, the

14 dislocation density after growth amounting to less than 10^5 cm^{-2} ,
15 and

16 selecting a total layer thickness of the layer structure
17 that during growth of the epitaxial layer it does not substantially
18 relax.

1 56. (previously presented) The method according to
2 claim 1 wherein a layer to be strained has a thickness d_3 in the
3 range of 1 to 50 nanometers.

4 57. (previously presented) The method according to
5 claim 1 wherein the silicon layer to be strained has a thickness d_3
6 in the range of 5 to 30 nanometers.

7 58. (previously presented) The method according to
8 claim 57 wherein the first layer has a thickness d_4 close to a
9 critical layer thickness for pseudomorphic growth.

1 59. (previously presented) The method according to
2 claim 58 wherein a layer thickness ratio d_4/d_3 is greater than about
3 10.

1 60. (previously presented) The method according to
2 claim 13 wherein the second layer has a thickness $d_5 = 50$ nanometer
3 to 1000 nanometer.

1 61. (previously presented) The method according to
2 claim 13 wherein the second layer has a thickness $d_5 = 300$
3 nanometer to 500 nanometer.

1 62. (previously presented) The method according to
2 claim 1 wherein the layer to be strained is locally strained.

1 63. (previously presented) The method according to
2 claim 62 wherein the layer to be strained is locally strained in
3 regions which are vertical in a plane with the defect region.

1 64. (previously presented) The method according to
2 claim 13 wherein the defect region is produced at a spacing of 50
3 nanometers to 500 nanometers from the layer to be relaxed.

1 65. (previously presented) The method according to
2 claim 1 wherein the defect region is at a spacing of 50 nanometers
3 to 100 nanometers above the first layer on the layer to be
4 strained.

1 66. (previously presented) The method according to
2 claim 13, further comprising the step of
3 removing the first and second layers after producing the
4 strained layer or after producing a strained region.

1 67. (previously presented) The method according to
2 claim 1 wherein wet chemical material-selective etching is used.

3 68. (previously presented) The method according to
4 claim 67, further comprising the step of
5 etching trenches in the depth of the silicon and
6 epitaxial layers.

1 69. (previously presented) The method according to
2 claim 68, further comprising the step, after producing the etched
3 trenches, of
4 relaxing the first layer or a further layer by a thermal
5 treatment.

1 70. (previously presented) The method according to
2 claim 68, further comprising the step of
3 filling the trenches with insulating material to produce
4 shallow trench insulation.

1 71. (previously presented) The method according to
2 claim 1, further comprising the step of
3 carrying out at least one further thermal treatment for
4 relaxation of at least one layer.

1 72. (previously presented) The method according to
2 claim 1 wherein a strained layer or an unstrained layer are
3 produced with a surface roughness of less than 1 nanometer.

1 73. (previously presented) The method according to
2 claim 72 wherein a surface roughness of the layer is further
3 reduced by the growth of a thermal oxide thereon.

1 74. (previously presented) The method according to
2 claim 1, further comprising the step of
3 producing on a strained region of the layer an n- and/or
4 p- MOSFET.

1 75. (previously presented) The method according to
2 claim 1, further comprising the step of
3 depositing a further epitaxial layer comprising silicon
4 or silicon/germanium or an Si-Ge-C layer or a germanium layer.

1 76. (previously presented) The method according to
2 claim 1, further comprising the step of
3 producing on a strained silicon-germanium region
4 p-MOSFETs as a further epitaxial layer or as a nonrelaxed layer
5 structures.

1 77. (previously presented) The method according to
2 claim 1, further comprising the step of
3 producing bipolar transistors on unstrained regions of
4 the layer to be strained.

1 78. (previously presented) The method according to
2 claim 77 wherein for producing a bipolar transistor, a silicon-
3 germanium layer is applied.

1 79. (previously presented) The method according to
2 claim 1, wherein the steps of claim 1 are carried out a plurality
3 of times.

80 - 98. (canceled)

1 99. (new) The method according to claim 19 wherein the
2 thermal treatment is carried out in nitrogen.

3 100. (new) The method according to claim 28 wherein at
4 least two implantations are carried out.

1 101. (new) The method according to claim 100 wherein a
2 hydrogen implantation is carried out in combination with a helium
3 implantation.

1 102. (new) The method according to claim 32 wherein
2 between two implantations a thermal treatment is carried out.

3 104. (new) The method according to claim 1 wherein the
4 total layer thickness of the layer structure is so selected that
5 during growth of the epitaxial layer it does not produce any
6 noticeable relaxation.